TECHNICAL MANUAL

GENERAL OPERATION AND INSPECTION OF INSTALLED FUEL STORAGE AND DISPENSING SYSTEMS

(ATOS)

F41608-87-D-A288

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This publication supersedes T.O. 37-1-1, dated 1 September 1989, which will be removed from active files.

Published Under Authority of the Secretary of the Air Force

31 DECEMBER 2003

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LIST OF EFFECTIVE PAGES

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Dates of issue for original and changed pages are:

Original ..... 0 .....31 December 2003

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INTRODUCTION

1. PURPOSE.

This technical order provides policies and guidance for fuels management personnel in the operation, inspection, and operator maintenance of permanently installed fuel facilities operated under the control of the Base Fuels Management Team (FMT). Federal, state, and local environmental laws and regulations shall be complied with if this publication is in conflict with them.

2. SCOPE.

The instructions prescribed by this publication outline general operational information associated with fuel storage and dispensing systems and provides the minimum periodic operator's maintenance requirements for the systems. This technical manual is to be used in conjunction with other existing directives governing fuel system operations and maintenance requirements; however, this technical order will take precedence where there is a conflict with other publications.

SAFETY SUMMARY

1. GENERAL SAFETY INSTRUCTIONS.

The following are general safety precautions and instructions that people must understand and apply during many phases of operation and maintenance to ensure personal safety and health and the protection of Air Force property. Portions of this may be repeated elsewhere in this publication for emphasis.

2. WARNING AND CAUTION STATEMENTS.

WARNING AND CAUTION statements have been strategically placed throughout this text prior to operating or maintenance procedures, practices, or conditions considered essential to the protection of personnel (WARNING) or equipment and property (CAUTION). A WARNING or CAUTION will apply each time the related step is repeated. Prior to starting any task, WARNINGs or CAUTIONs included in the text for that task will be reviewed and understood.

3. WEARING OF JEWELRY.

Remove rings, watches, and other metallic objects which may cause shock or burn hazards. Finger rings will also be removed when working in areas where the potential exists for rings to catch during a slip or fall, i.e., climbing on tanks or tank trucks or at the discretion of the Fuels Management Flight Commander (FMFC).

4. RESUSCITATION.

Personnel working with or near dangerous voltage shall be trained in modern methods of resuscitation. Information and training may be obtained from the Director of Base Medical Services.

5. PERSONAL PROTECTIVE EQUIPMENT (PPE).

If unique local conditions make compliance with the protective clothing or other occupational health requirements specified in this manual unnecessary or impractical, obtain an evaluation of the operation from the Bio-Environmental Engineer. The Bio-Environmental Engineer will determine the required precautions.

6. STATIC ELECTRICITY.

Grounding and/or bonding of all conductive parts of the system is an effective means to prevent an electrostatic spark that could cause ignition of petroleum product(s). To prevent personnel injury, always ground and/or bond equipment in accordance with applicable directives.

7. CONFINED SPACE ENTRY.

Personnel have been overcome by fuel vapors in confined spaces. Prior to entering a confined space, ensure requirements established in AFOSH Standard 91-25 have been met.

CHAPTER 1
RESPONSIBILITIES

1.1 ORGANIZATIONS.

Responsibility for the operation and maintenance of permanently installed base petroleum systems rests with Fuels Management (FM) and Civil Engineers (CE). The Transportation Officer provides maintenance support for mobile/portable fueling equipment.

1.2 FUELS MANAGEMENT (FM).

FM shall develop procedures and local operators inspection and maintenance checklists to ensure the safe and efficient operation of installed and mobile fuel systems/equipment.

1.3 CIVIL ENGINEERS (CE).

CE shall perform all maintenance and associated procurement actions on installed fuel systems, to include additive injectors, and nozzle/hose assemblies on truck fillstands. The hydrant adapters on installed refueling systems are real property components. CE provides detailed and updated schematic drawings and certified gauging charts applicable to the installed systems.

1.4 LOGISTICS READINESS SQUADRON TRANSPORTATION OFFICER.

The Logistics Readiness Squadron Transportation Officer provides maintenance support for mobile/portable fueling equipment.

1.5 DET 3, WR-ALC.

DET 3, WR-ALC/AFTH is the office of primary responsibility for the technical content of this technical order. Recommended changes and/or improvements to this technical order will be submitted In Accordance With (IAW) T.O. 00-5-1.

CHAPTER 2
OPERATING PROCEDURES

2.1 GENERAL.

This chapter provides general operating procedures for fuel receipt, storage, transfer, and issue. The systems utilized to perform these operations will vary in arrangement of pumps, piping, electrical equipment, and assorted components. Personnel performing fuels handling operations with these systems will be proficiency evaluated and qualified IAW AFI 23-201 and AFI 36-2201 prior to performing these duties without supervision. In addition, a working knowledge of the design and function of system components will aid in localizing maintenance problems. Specific operating procedures applicable to the installed item will be provided by the installation CE. Safety precautions and servicing constraints outlined in T.O. 00-25-172 must be followed during aircraft fueling operations. Fuels personnel must comply with the lightning and hazardous weather instructions outlined in AFOSH Standard 91-38 and AFI 23-201.

a. A two-person policy is required for safety reasons for most fuel handling operations. AFI 23-201 provides specifics.

b. Bulk fuel off-loading headers not within secure fenced areas must be key locked IAW AFI 23-201.

c. The Liquid Fuels Maintenance (LFM) element will coordinate all maintenance activities with the Resources Control Center (RCC) prior to start and completion of work on any fuel system.

d. All local procedures and checklists covering the movement of fuel will contain emergency shutdown procedures.

e. Before fuel off-loading operations begin, ensure the receiving tank has sufficient ullage to receive the product.

f. Conspicuously post the Safety Guide for Hydrocarbon Fuels (AFOSH Standard 91-38, Attachment 3) at permanently installed facilities.

2.2 FIRE PROTECTION.

a. Adequate fire protection shall be provided and properly located as determined by the Base Fire Chief. Danger signs for bulk fuel storage areas will be worded as follows: NO OPEN FLAME OR IGNITION SOURCE BEYOND THIS POINT.

b. When practical, danger signs will be posted 50 feet from dike areas, tank vents, low point drains, and lateral control pits. Signs will be worded NO OPEN FLAME OR IGNITION SOURCE WITHIN 50 FEET. These signs should be low profile and visible to approaching personnel.

c. The number and location of these signs will be determined by the Base CE in consultation with Ground Safety. Coordination with Airfield Management IAW AFI 13-213 is required before posting any signs in the flight line area.

2.3 FUEL RECEIPTS.

When a shipment of fuel arrives on base, the receipt documentation and inspection procedures will be IAW AFMAN 23-110, DoD 4140.25M, T.O. 42B-1-1, AFI 23-201, and MIL-STD-3004.

2.4 FROZEN VALVES.

WARNING

Under no circumstances shall an open flame or electrical heating element be used for thawing frozen valves on tank trucks/cars.

A steam jet, hot water, or hot cloth may be used to thaw frozen tank car/truck valves.

2.5 RECEIPT OPERATIONS TANK TRUCK/CAR.

NOTE

A visual fuel flow indicator will be installed on the off-loading headers to allow visual quality assurance and enable the operator to shut off the pumps when off-loading is complete. See MIL-HDBK-1022A for indicator specifications.

The following procedures will be used in conjunction with directives referenced in Paragraph 2.3.

a. Before fuel off-loading operations begin, ensure the receiving tank is the correct grade and has sufficient ullage to receive the product. Also, to remove any internal water perform product recovery operations on the jet fuel tanks that will receive fuel.

b. Ensure the fuel transport conveyance is properly positioned to allow for rapid egress in case of emergency. Ensure grade, quantity, and seal numbers (if applicable) agree with the DD Form 250,

Bill of Lading, or contractor delivery ticket. If the documentation is not available upon arrival of the conveyance, contact the appropriate DLA quality representative and follow the procedures in AFMAN 23-110.

c. Place danger signs at least 50 feet from tank trucks/cars prior to the beginning of off-loading operations. Signs are not required when off-loading at the base service station or within posted secured areas.

d. Connect grounding/bonding cable to a metal surface on the tank truck/car (see Figure 2-1 and Figure 2-2). No grounding/bonding is required for railroad tank cars if the spur tracks are bonded together/grounded or electrically isolated from the main line as determined by CE Electric Shop personnel.

WARNING

Due to the inherent fall potential, personnel should not routinely climb on top of fuel tank trucks or tank cars. Bases equipped with ATG, Visual Flow-type gauges, and in-line sampling connections on receipt headers shall develop procedures to minimize the time personnel must go on the top of tank trucks and tank cars to ensure quality/quantity of DESC-owned product.

e. Check seals and perform required fuel quality sampling, if required and as necessary.

WARNING

Do not open tank car manifold valve prior to connecting the off-loading hose. The valve is spring-loaded and when actuated is 100% open.

f. Ensure the off-loading outlet valve is closed and a metal or rubber drip pan is placed under the outlet and bonded to the tank car/truck prior to removing the dust cap. If rubber containers are used, bonding is not required.

g. Connect off-loading hose to tank truck/car off-loading outlet.

h. Open valves IAW local procedures.

i. Observe system for leaks.

j. Upon completion of off-loading product, close valves IAW local procedures.

k. Ensure tank truck/car is empty, close dome (if applicable) and remove off-loading hose.

l. Remove grounding/bonding cable and drip pan.

2.6 PIPELINE, BARGE, AND TANKER RECEIPTS.

Ensure communication (hot line, radio, telephone, etc.) between pipeline pump station, barge, or tanker and receipt location is established prior to starting any receipt actions. Communication devices in hazardous areas must be suitable for use in Class I, Division 1, Group D areas.

a. Only trained personnel familiar with the systems' operating actions are permitted to perform product receipt.

b. Barges and tankers will be grounded/bonded IAW UFC 3-460-03.

CAUTION

Receiving simultaneously into multiple (i.e. manifold) storage tanks is not authorized unless all tanks are equipped with high level alarms or high level automatic shutoff valves.

c. Check receipt paperwork. Ensure the storage tank(s) contain the correct grade of fuel and has sufficient ullage. Product recovery systems will be operated to remove all water prior to receipt.

d. Open valves required to fill the receipt tank(s) IAW local procedures.

e. When the receipt (off-loading operation) is complete, close all valves IAW local procedures.

f. Remove grounding/bonding cables.

2.7 TRANSFERRING PRODUCT BETWEEN BULK AND OPERATING STORAGE.

The following will be accomplished:

a. Ensure adequate communication is available between transfer and receiving points. If telephone communication is used, ensure a telephone alarm can be heard from outside of the transfer and receiving points.

b. Ensure the storage tank contains the correct grade of fuel and has sufficient ullage. Product recovery systems will be operated to remove water prior to the transfer.

c. Open appropriate valves IAW local procedures on selected tanks and piping.

CAUTION

Receiving simultaneously into multiple (i.e. manifold) storage tanks is not authorized unless all tanks are equipped with high level alarms or high level automatic shutoff valves.

d. Receiving operator must be stationed in the immediate vicinity of the tank to monitor the receipt unless the tank is equipped with a high level alarm that can be heard outside of the tank area.

e. Upon completion of transfer, close appropriate valves and reposition electrical controls IAW local procedures.

f. Complete accounting documents IAW AFMAN 23-110.

2.8 FILLING BULK STORAGE TANKS.

Storage tanks present greater electrostatic hazards due to their large size. It is possible to have an electrostatic discharge from the surface of the liquid to the tank shell or to objects within the tank or container. Bonding and grounding do not eliminate this potential interior hazard. Time is required for the electrostatic charge in the fuel to relax.

CAUTION

Receiving simultaneously into multiple (i.e. manifold) storage tanks is not authorized unless all tanks are equipped with an operational high level alarm or high level automatic shutoff valves.

a. Top filling where the fuel free falls or splashes is prohibited. Electrostatic charges buildup very rapidly during this type of operation and can cause an explosion.

b. The fill rate for an empty (or nearly empty) tank must be reduced to prevent excessive agitation, turbulence, spraying, and misting which results in a high rate of static generation. The fuel velocity shall not exceed 3 feet per second until the liquid level is 1 foot above the inlet level. Floating roof tanks require the same precautions until the roof becomes buoyant (see Table 2-1). CE will provide procedures and checklists to ensure the 3 feet per second is maintained.

c. The presence of water, entrapped air, or foreign particles in the fuel tends to increase the static charging rate. Care must be exercised to prevent the entrance of these materials into the fuel system.

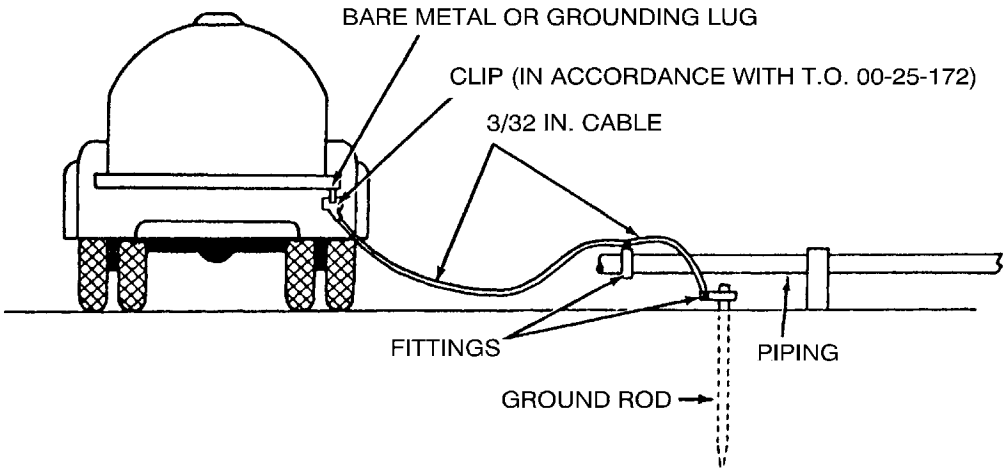

Figure 2-1. Tank Truck Grounding

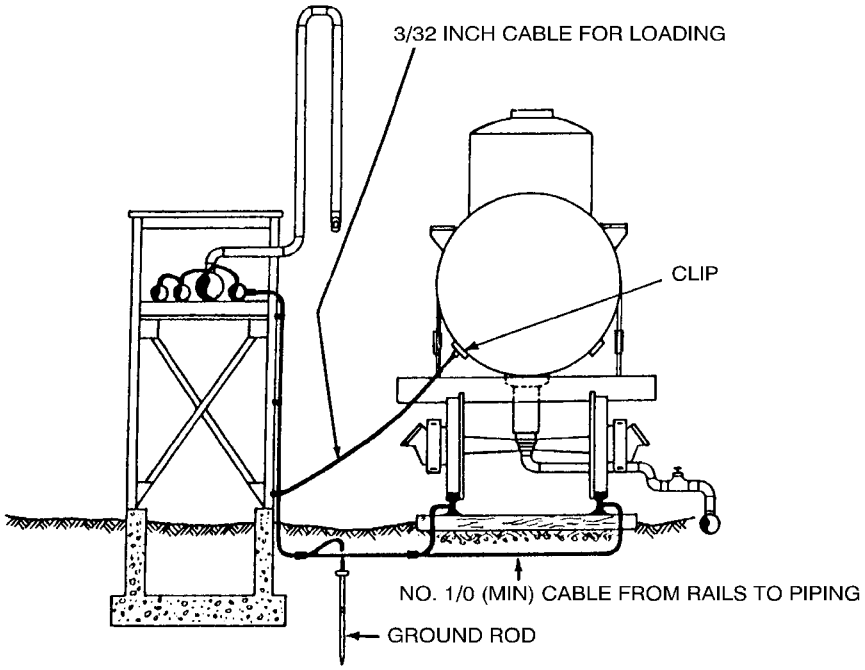

Figure 2-2. Tank Car Loading

Table 2-1. Initial Flow Rates for Storage Tanks

Pipe Size	3 Ft/Second Velocity	
	Gal/Min	Barrels/Hour
4 inches	120	171
6 inches	270	385
8 inches	480	685
10 inches	750	1,071
12 inches	1,080	1,542
14 inches	1,470	2,099
16 inches	1,920	2,741

d. Personnel will not be allowed in pits located on top of underground or cut and covered/hardened tanks during fuel receipt or transfers. Personnel are also restricted from on top of aboveground storage tanks during fuel receipt or transfer.

e. Storage tank manual gauging, if required, will not be performed during or for 30 minutes after filling (see Paragraph 2.12).

f. Sampling will be IAW T.O. 42B-1-1.

2.9 IGNITION HAZARDS DURING FUEL TRANSFER FROM STORAGE TANKS BY OTHER THAN NORMAL MEANS.

a. Fires have occurred as a result of using unauthorized portable pumps during fuel handling operations. Such accidents have occurred during the following operations:

(1) Preparation for and during tank cleaning.

(2) Transfer of product from a storage tank when the installed fuel transfer pump is inoperable.

(3) Transfer of product from a storage tank where there is no installed fuel transfer pump.

(4) Removal of water from fuel tanks where no sump drains exist.

(5) Removal of water from various pits in the fuel system where fuel/water may collect.

(6) Handling waste or recoverable fuels.

CAUTION

In order to maintain quality control of the system, residual fuel or sludge from a tank will not be removed through the manifold/transfer lines.

b. When fuel tanks are being prepared for cleaning or maintenance, fuels personnel will remove fuel to the lowest point possible utilizing the installed pumping system or by gravity flow. Upon completion, the entire operation will be transferred to CE who will remove any recoverable fuel IAW applicable directives. Residual fuel or sludge will be removed by the tank cleaning crew assigned by CE or contract.

c. When fuel is stored in tanks where the installed pump is inoperable and cannot be repaired in a timely manner or no installed pump exists, the following will apply, except as noted in Paragraph 2.9c (2) and (3) below.

(1) Fuel will be removed by use of:

(a) One of the pumps in AS 488.

(b) A fuel servicing unit selected by the FMFC provided distance pump suction, and safety requirements can be met and quality is not compromised. R-9, R-11, and C-300 refuelers shall not be used to remove product from underground tanks because of possible pump damage.

(2) Tanks used for the collection/storage of waste fuel are exempt from the requirement for installed pumps. However, removal of fuel from such tanks must be by pumps listed in AS 488, by approved contractor methods, or use of a vehicle specifically designated for handling waste petroleum and so identified with proper labeling IAW T.O. 36-1-191.

(3) Fuel tanks, located at military service stations, which are used to support both vehicle fleets and tank truck delivery operations are not required to have installed transfer pumps in addition to the normal vehicle delivery pumps. However, when the installed vehicle service station pump is used to fill tank trucks, the provisions of Paragraph 2.9c(1)(a) and (b) apply for the transfer of product from the service station tank to the truck/trailer.

d. Removing water from fuel tanks without sump drains, or from various pits or other areas where water may collect, requires the same precautions as if fuel was being handled. Only approved equipment will be used, such as the equipment listed in AS 488. Removing water with hand operated pumps is authorized.

2.10 PUMPS.

WARNING

The use of internal combustion engine driven, reciprocating, open-diaphragm pumps (Mud Hog), for pumping petroleum products, is prohibited.

a. Several types of pumps may be used for fuel transfer operations. The pumps may be driven by electric motors, air, or internal combustion engines. In all cases, electrical equipment must conform to the safety requirements outlined by the National Fire Protection Association (NFPA) 70, the National Electrical Code (NEC) for Class I, Division I, Group D. All the internal combustion engines must conform to MIL-HDBK-201 and must be equipped with a spark arresting exhaust system, shielded ignition system, and totally enclosed spark plug (aircraft engine type) with screw cap.

NOTE

Substitution is authorized provided the substitute pump (if electrical) conforms to Class I, Division I, Group D, as defined by the National Electrical Code, or (if a combustion engine) conforms to Paragraph 2.10a.

b. AS 488 specifies the pumps authorized for handling petroleum products. The AS 488 will be amended as other authorized pumping units become available.

c. Pumps installed for issuing gasoline from military service stations or organizational issue tanks must have flow restrictors installed to limit flow rates to maximum of 10 gallons per minute. This requirement is optional when: (1) organizations handle less than 10,000 gallons of gasoline per month, and (2) dispensing pumps are dedicated to servicing heavy-duty vehicles.

2.11 PRODUCT SETTLING.

Product settling will be IAW T.O. 42B-1-1.

2.12 GAUGING.

WARNING

A minimum waiting time of 30 minutes after completion of fuel receipts, transfers, or movements is required before insertion of any object into storage tanks. This is a safety measure to permit relaxation of electrostatic charges.

When available, Automatic Tank Gauging (ATG) is the primary method of fuel tank inventory control. Whenever the accuracy of an ATG is questioned, a calibration for inventory control must be performed IAW the Manual of Petroleum Measurement Standards, Chapter 3 (Tank Gauging), Section 1B (Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Tanks by Automatic Tank Gauging). Accordingly, for manual tank gauging operations, the procedures outlined in the Manual of Petroleum Measurement Standards, Chapter 3 (Tank Gauging), Section 1A (Standard Practice for the Manual Gauging of Petroleum and Petroleum Products) must be complied with.

2.13 LEAK DETECTION.

The FMT will coordinate with the BCE and the Base Environmental Manager to ensure leak detection systems are in place that comply with federal, state, and local environmental requirements.

2.14 PRODUCT RECOVERY SYSTEM AND OIL/WATER SEPARATOR.

a. Operation of the product recovery system and water drain system will be constantly attended by a qualified fuels operator and/or LFM personnel.

NOTE

The fuel/water will not be drained onto the ground. Dispose of IAW local, state, and federal environmental laws and regulations.

(1) Unlock the water draw-off valve and position valves to allow flow into recovery tank.

(2) Ensure the product recovery tank is capable of holding the recovery line displacement plus 20 gallons of liquid. Fill the recovery tank with product. If cloudy, drain into a bowser or collection tank and continue the recovery tank fill/drain process until the product becomes clear in appearance.

(3) Allow water to settle in fuel recovery tank; observe the water drain off through the sight glass.

NOTE

Due to hazards of handling water with FSII concentrations, engineer a system that will preclude any manual handling of tank water bottoms. T.O. 42B-1-1 and T.O. 42B-1-23 outline procedures for handling water bottoms.

(4) Position appropriate valves and transfer all drained fuel back into tank. To prevent lines from freezing and becoming inoperative at northern tier locations, product recovery systems can remain full of fuel upon completion of water draining operations. This practice will be limited to only those locations that experience routine subfreezing temperatures, and is authorized only during the time of year these temperatures are expected.

(5) Close appropriate valves upon completion of fuel transfer.

(6) Lock the water draw-off valve.

b. Oil/water separators are real property. Maintenance and operation is the responsibility of CE.

(1) Position oil skimmer so slot is level with top of water in the separator to properly separate fuel from water.

(2) Open the gate valve of the separator pit.

(3) Ensure only fuel is flowing into the relief tank from the oil skimmer.

(4) Regulate water flow as required.

(5) Close the gate valve when water flow has stopped.

(6) Water will be drained and disposed of IAW federal, state, and local environmental laws and regulations.

2.15 TANK CLEANING AND INSPECTION CRITERIA.

a. FM must be familiar with tank inspection and cleaning requirements IAW UFC 3-460-03. Sample IAW T.O. 42B-1-1 and for Special Fuels IAW T.O. 42B1-1-16.

b. Tank inspections/cleaning will be scheduled according to UFC 3-460-03. Minor deviation in frequency of tank inspection because of nonavailability of tank cleaning personnel or a

Bio-Environmental Engineer, receipt problems, etc., are permitted for up to 45 days. Periods in excess of 45 days must be approved by the MAJCOM Fuels Officer/Fuels Engineer. Locations with large amounts of dormant storage that cannot rotate the product to empty tanks to perform tank inspections/cleaning without creating severe operational problems can request a time extension from their MAJCOM Fuels Officer/Fuels Engineer, provided fuel sample results are satisfactory.

2.16 SERVICING CONTROLS.

Servicing controls are required to assure the correct grade of fuel is issued by refueling equipment. Refueling equipment must be filled with the correct fuel and the right equipment must be used to dispense the fuel to the aircraft/equipment. Quick-disconnect couplers (such as Kamlok or equivalent) will not be used in permanently installed fillstands. However, quick-disconnect couplers may be used when storage fillstands are used to support inter-service refueling equipment such as Army refueling vehicles. If quick-disconnect couplers are required by a T.O. on portable fuel systems, they will be safety-wired (minimum 4 strand wraps) or secured with nylon cable ties. For locations with more than 1 grade of aviation fuel, the use of selective couplers for bottom loading refueling units from fillstands is mandatory.

NOTE

Additional requirements for servicing controls are outlined in AFI 23-201.

a. The use of selective couplers for bottom loading of ground fuels from fillstands is required, and the type of coupler used for each grade will be determined by the MAJCOM.

b. Bottom Loader Requirements:

(1) Jet Fuels – the single point receptacle will be used on jet fuel refueling units with a single point nozzle on the fillstand. Where more than 1 grade of jet fuel is handled at a base, the 3-inch dry break coupler may be used and a lock control system for the refueler bottom loader control is required. Strainers are not required in fillstand single point nozzles.

(2) Avgas – where 1 grade of avgas and 1 grade of jet fuel is handled at the base, FM will assure a positive control method is in effect to prevent commingling of fuel.

(3) Ground Fuels – MAJCOMS will develop a positive control method to prevent commingling of products and implement resource protection controls IAW AFI 23-201. The following are recommended servicing controls:

NOTE

Organizational tanks are exempt from bottom loading requirements. Examples of mobile organizational tanks are A1B trailers and skid POD tanks.

(a) Diesel Fuel – if 2 grades of diesel are handled, the couplers will be reversed; i.e., diesel fuel unit will have a male fitting with a female fitting on the fillstand; biodiesel fuel unit will have a female fitting with a male fitting on the fillstand.

(b) Unleaded Mogas – the 2-inch dry break type coupler will be used.

2.17 DISPENSING FUEL FROM TRUCK FILLSTAND BOTTOM LOADING.

a. The refueling unit operator will engage the parking brake. Gasoline powered vehicle engines will be turned off unless waived by the MAJCOM Fuels Office.

NOTE

Engines may continue to run on R-9/11 refuelers while filling at the fillstand. Engines on C-300 will be turned off unless waived by the MAJCOM Fuels Office.

b. Ensure vehicle is bonded to the fillstand or hosecart (bonding is not required for all-metal pantograph arms if there is a continuous metal structure from the fillstand to the fuel servicing equipment). Grounding the hosecart or vehicle is not necessary. Bond the refueler to the hosecart.

c. Position valves and electrical controls IAW local procedures. Perform the issue operation.

d. Upon completion of the issue, push stop switch on the fillstand to ensure the pump is not operating, position valves and electrical controls IAW local procedures.

e. Complete accountable documents IAW AFMAN 23-110.

f. Disconnect and stow grounds/bonds.

2.18 TANK TRUCK/CAR TOP LOADING OPERATION.

An approved waiver will be obtained from the parent MAJCOM Fuels and Safety Officers prior to performing fuel top loading operations. A recognized hazard of top

loading is the turbulence, splashing, and spraying of product resulting from too high initial fill rate and downspouts not being extended to the bottom of the tank. The following measures will be used to minimize the potential hazard.

a. The storage operator will direct refueler operator in positioning the vehicle to prevent stress on components during the fuel transfer.

b. Ensure the vehicle is bonded to the fillstand.

c. Position valves and electrical controls IAW local procedures.

d. Begin filling at an initial rate not to exceed 3 feet per second. This flow will be observed until the fuel level is at least 1 foot above the opening of the downspout.

e. Upon completion of the issue, stop the pump and position valves and electrical controls IAW local procedures.

f. Disconnect and stow ground/bond cable.

g. Complete accountable documents IAW AFMAN 23-110.

2.19 REFUELING UNIT RETURN TO BULK STORAGE (RTB).

a. The refueling unit operator will position the vehicle as directed by the storage operator.

b. Ensure the vehicle is bonded to the storage system.

c. The storage operator will ensure there is ullage in the storage tank. Open appropriate valves IAW local procedures.

d. Upon completion of the operation, position all valves IAW local procedures.

e. Disconnect and stow grounding/bonding cables.

f. Complete accountable documents IAW AFMAN 23-110.

2.20 SERVICE STATION OPERATION.

WARNING

- Cell phones may cause an explosion/fire if used when fueling a vehicle with gasoline. Conspicuously post a sign at the pumps which states: NO CELL PHONES. TURN CELL PHONES OFF PRIOR TO FUELING VEHICLE.
- Plastic truck bed liners have caused static buildup that resulted in a fire while filling gasoline cans. Place a danger sign(s) conspicuously located at the pumps depicting the words: DANGER – FILLING FUEL CONTAINERS ON PLASTIC BED LINERS CAN RESULT IN FIRE/EXPLOSION. PLACE CONTAINERS IN CONTACT WITH THE GROUND.

NOTE

Pumps installed for issuing gasoline from military service stations or organizational issue tanks must have flow restrictors installed to limit flow rates to maximum of 10 gallons per minute. This requirement is optional when: (1) organizations handle less than 10,000 gallons of gasoline per month, and (2) dispensing pumps are dedicated to servicing heavy-duty vehicles.

The following procedures will be adhered to:

a. Storage personnel open appropriate issue valve(s) and position electrical controls.

b. For automated service stations, ensure complete operating instructions are conspicuously posted.

c. See AFI 23-201 and AFOSH Standard 91-38 for guidance associated with operating the Automated Fuels Service Station during lightning and weather warnings.

2.21 HYDRANT ISSUES TO AIRCRAFT OR REFUELING UNIT(S).

NOTE

Multiple refueling (hot or cold) on a single Type II hydrant system lateral is authorized provided the servicing equipment has an automatic pressure control valve with a deadman control or a pit control valve with a deadman control at the hydrant outlet. Also, the requirement for secondary filtration at the skin of the aircraft must be met or the lateral piping must have internal epoxy coating per T.O. 42B-1-1. Equipment used for hot refueling must be IAW T.O. 00-25-172.

a. Select operating tank(s).

b. Position pump selector switch(es) and open appropriate valves to the tank(s) IAW local procedures.

c. The MAJCOM Fuels Office shall develop a formal Fuels Operating Instruction/Policy Document outlining the manning requirements for Type I, II, IV, and V Hydrant Systems.

d. Type III pumphouses shall be manned or have an operator in the immediate vicinity when the selector switch is in the AUTOMATIC mode unless the RCC is equipped with an operable PUMP ON indicator light and emergency shutoff switch. When a Type III system is not going to be used for extended periods, turn the selector switch to OFF.

e. Upon completion of fueling operation, close appropriate valves and reposition electrical controls IAW local procedures.

2.22 DEFUELING INTO HYDRANT SYSTEMS.

Close monitoring of this operation is required. Ensure there is sufficient ullage in the tank to receive the defuel. It may be necessary to transfer fuel to other tanks to prevent an overflow if the system has limited defuel capacity or a high level shutoff/alarm system. Detailed procedures will be developed locally.

NOTE

T.O. 00-25-172 identifies the aircraft certified for rapid defueling.

CHAPTER 3
OPERATOR'S INSPECTION AND MAINTENANCE

3.1 GENERAL.

This chapter provides guidance on inspection procedures and reporting deficiencies. Operational, weekly (not to exceed 7 days), monthly (not to exceed 31 days), quarterly (not to exceed 90 days), and semiannually (not to exceed 180 days) inspections are made by the operator or appropriate agency to identify deficiencies or maintenance needs which if uncorrected can compromise the safe and efficient operation of the fuel system. The records of inspections and deficiencies will assist FM in determining the operational status of the system and to initiate actions to correct any deficiencies. Additional inspection and maintenance policy/guidance is given in UFC 3-460-03.

3.2 SYSTEM DEFICIENCY.

Any deficiency compromising quality of product, hazards to the environment, or safety of operation and personnel will be considered adequate justification for placing the system out of service utilizing the AF Form 979, Danger Tag, IAW AFI 23-201 and AFOSH Standard 91-45. The FMFC will inform the Commander, MAJCOM Fuels Office, and affected agencies of any deficiency which compromises accomplishment of the mission.

3.3 DISCREPANCY RECORD.

FM will report all deficiencies to the CE. Deficiencies will be recorded on the AFTO Form 39, Fuel System Inspection Guide and Discrepancy Record. Only those items that affect fuel system operations, product quality, or safety will be recorded on the AFTO Form 39 discrepancy section. General housekeeping items shall not be included (i.e., replacement of light bulbs, broken windows, leaking water faucets, door discrepancies, etc.). General housekeeping items being monitored may be filed along with the AFTO Form 39.

3.4 INSPECTION GUIDE.

Base fuel systems will be inspected using the AFTO Form 39. A computer generated AFTO Form 39 may be used provided the form does not take away from the intent of the current form. Each form provides a monthly record of system inspections and maintenance actions. A separate form will be used for each of the following areas:

a. One for each bulk storage area.

b. One for each immediate operating storage system.

c. One for each automotive service station.

d. One for each liquefied petroleum gas system.

e. One for each compressed natural gas system.

f. One for each deicing fluid system.

3.5 ACTIVE SYSTEMS.

The system will be inspected prior to/during each use. The portion of the system being utilized must be monitored periodically for deficiencies.

3.6 FILES.

The completed AFTO Form 39 will be retained by FM for a period of 3 years IAW AFMAN 37-139. AFTO Forms 39 may be kept on file longer than 3 years if required to support more stringent environmental mandates.

3.7 AFTO FORM 39, PAGE 1.

Complete as follows:

a. Facility No. and Type – enter the assigned fuel system number and type fuel system, i.e., TYPE I, II, III, etc.

b. Date – enter the applicable month and year.

c. Supervisor – enter the name and rank of the supervisor or person responsible for that particular system.

d. Items to Be Inspected – additional inspection items may be incorporated for local use as directed by the FMFC. Items not associated with the system being inspected will be marked out on the AFTO Form 39. For those locations having an automated service station, refer to the operation manual and annotate AFTO Form 39 as appropriate.

e. Items to Be Inspected Weekly – operator will annotate the date of weekly inspection in the blocks provided.

f. Items to Be Inspected Monthly – the operator will annotate completion dates.

g. Items to Be Inspected Semiannually – carry forward past inspection dates. After the inspection is performed, change date to reflect the current inspection.

h. Fuels Supervisor Inspection – the fuels storage supervisor must perform weekly inspections and

annotate the AFTO Form 39 in the FUELS SUPERVISOR INSPECTION section.

i. The signature area with corresponding lines and 31 numbered blocks on the AFTO Form 39 may be used at the option of the applicable MAJCOM Fuels Office.

3.8 AFTO FORM 39, PAGE 2.

The following is an explanation of the column headings:

a. Discrepancy – enter a brief description of each individual discrepancy.

b. Date Disc – enter date the discrepancy is discovered.

c. Date – enter date the discrepancy is reported to CE.

d. Time – enter the time discrepancy is reported to CE.

e. Initial – the individual completing the REPORTED TO MAINTENANCE part will initial in this space.

f. Work Order Number – enter the Job/Work Order Number provided by CE (via telephone or by receipt of Job/Work request form).

g. Maintenance Status – this section will be completed in pencil by LFM personnel. When a status code changes, the date will be changed to correspond to the date the status code changes. If no code change on the carried forward list from the previous month AFTO Form 39, the storage supervisor will initial the open entries.

(1) Date – enter date maintenance action is initiated or status code is changed.

(2) Status Code – enter appropriate code.

(3) Follow-up Date – enter date of follow-up action for open work orders.

(4) Initial – individual annotating status code will enter their initials.

3.9 MANAGEMENT MONTHLY INSPECTION.

a. The fuels storage supervisor must perform weekly inspections and sign/date the AFTO Form 39 in the LFM/Fuels Supervisor Inspection (Page 1). At least once a month, the LFM supervisor and FMFC or Fuels Manager/Superintendent will conduct an inspection of each storage system. Although preferred, it is not mandatory for both functional areas to perform the inspection concurrently. Upon completion of the monthly inspection, the LFM supervisor and the person performing the Fuels inspection shall sign and date the AFTO Form 39 in the LFM/FUELS FACILITIES SUPERVISOR INSPECTION Section (Page 1). The inspection by the FMFC/Fuels Manager/Superintendent will suffice for the weekly inspection performed by the fuels storage supervisor.

b. The FMFC and Fuels Manager/Superintendent will review completed AFTO Forms 39 monthly and sign on Page 2 accordingly. The remarks section will be used to explain circumstances which prevent any inspection. Criteria for LFM inspection frequency is found in UFC 3-460-03.

c. Monthly inspections of unmanned locations will be performed by the FMFC. This inspection may be performed by a designated representative provided the FMFC performs the inspection at least once during each quarter.

3.10 OPEN DISCREPANCIES.

When a new AFTO Form 39 is initiated, all open discrepancies including the maintenance status will be transcribed to the new Fuels System Inspection and Discrepancy Record.

3.11 OPERATIONAL INSPECTIONS.

Items requiring inspection during operation as shown on AFTO Form 39 under OPERATIONAL are explained below. Items which are not installed in the system will be lined out.

a. Hoses, Nozzles, and Couplers – installation and maintenance will be IAW T.O. 37A-1-101.

(1) Inspect nozzles and couplers for serviceability.

(2) Check hose for wear, abrasion, and slippage at the coupler. If determined by the FMFC or LFM that protection of the hose is needed, hose protection can be provided by the use of a polyurethane plastic sleeve commonly known as a slinky. The slinky can be ordered in 3 colors: optic orange, NSN 4720-01-328-8846; dark green, NSN 4720-01-328-8845; and sand matte, NSN 4720-01-328-8844.

(3) When hose is not in use, store on hangers or racks, and keep covered. Hoses must not be allowed to be stored with kinks.

(4) All hoses not connected to a nozzle will be capped IAW T.O. 37A-1-101.

(5) Keep clean and free from oil and grease.

(6) Check for hose slippage.

b. Static Ground/Bonding Hardware (if installed).

NOTE

Ohm continuity checks required upon initial installation, when repaired, and whenever continuity questioned.

(1) Clamp – inspect for serviceability. Replace clamp if jaws are deformed or corroded, spring is weak, or other defects are evident that would prevent a good connection.

(2) Plug – inspect the electrical ground/bond plug for corrosion, weakness, or loose nuts and replace if heavily dented or deformed.

(3) Cable – replace cable if more than one-third of the cable wires are broken. If electrical continuity is suspect, the cable will be checked and replaced if found to be defective.

(4) Static Grounding/Bonding Reel – visually inspect for security of mount to rigid base and evidence of any corrosion or damage.

c. Pumps and Motors.

(1) Check for unusual noise or vibration during operation.

(2) Check for overheating during operation.

(3) Clean regularly at and below connections. Look for fuel residue accumulation on surfaces below connections and fittings.

(4) Service station dispensing systems that have automated leak detection with an alarm or pump disabling mechanism do not require visual inspection inside the pump dispensers.

d. Leaks – all fuel leaks will be promptly reported, corrected, and eliminated on a priority basis. Any fuel leak is a safety and environmental hazard and will be cause to place the system out of service until the problem is corrected by the proper authority.

e. Filter Separators.

(1) Ensure elements are within time criteria use limits IAW T.O. 42B-1-1.

(2) Ensure automatic water drain valves are removed, plugged, or made inoperative. Automatic water discharge valves and lines on filter separators that meet USAF standard design criteria shall not be removed or made inoperative. The automatic water discharge valves and lines on filter separators that meet USAF standards connect directly into a product recovery tank equipped with an operational high level shutoff and high level alarm. On filter separators that do not meet USAF design criteria, the automatic water discharge valve and line shall be removed or rendered inoperative.

NOTE

The procedure for removing/disabling filter separator automatic drain valves are addressed in HQ AFCESA/ENM letter dated 26 APR 93. Point of contact is Mr. Alvin L. Day, HQ AFCESA/ENM, DSN 523-6357.

(3) Ensure manual drain valve on sump is closed.

(4) Ensure Differential Pressure (DP) is within limits IAW T.O. 42B-1-1.

(5) Check Haypack Filter element changeout date. Use manufacturer's recommended changeout criteria.

f. Valves.

(1) Ensure valves are positioned per operating instructions.

(2) Check for damage and visual functional discrepancies. Lubricate as required. Ensure valves are numbered/lettered.

g. Pits and Outlets.

(1) When entering pits, follow procedures for confined space entry contained in AFOSH Standard 91-25.

(2) Check pits and hydrant outlets to ensure they are clean and dry.

(3) Check if installed sump pumps are operative.

(4) Check pit covers for damage.

(5) Check hydrant outlets for damage.

(6) Ensure hydrant outlet dust covers are in place and serviceable.

h. Tanks.

(1) Check exterior for corrosion, settling, damage, and warping.

(2) During inclement weather only (snow or ice), inspect open top floating roof tanks daily to assure the roof seal will not be damaged by tank operation. Verify roof drains are not obstructed.

(3) Remove internal water IAW T.O. 42B-1-1. At locations where product recovery systems are not provided, action will be initiated to have

them installed. Perform tank product recovery operations daily when used and/or prior to a fuel receipt/transfer operation. Increase the draining frequency to twice daily/each shift (depending on the severity) if large amounts of water, cloudy fuel, and/or any quantities of a viscous substance (apple jelly) are detected.

(4) Check tank vents for freedom of obstruction daily especially during freezing weather. After roofs are drained in freezing locations, ensure anti-freeze is replaced in the drain pipe.

(5) Check condition of ladders and tracks. Visual inspection only for proper alignment, rust formations, etc.

(6) Check interstitial space pressure readings, note increases/decreases.

i. Meters.

(1) Observe for proper operation. Whenever performance is suspected, the meter will be calibrated IAW UFC 3-460-03.

(2) Ensure meters are properly sealed, not overdue calibration, and labeled with calibration data IAW UFC 3-460-03.

j. Unloading Headers.

(1) Ensure dust covers are installed.

(2) Inspect ground/bond cables/clips for serviceability.

(3) Ensure headers are secured if required IAW AFI 23-201.

k. Pressure and Flow Recorder (Type III, IV, and V Systems).

(1) Ensure pressure and flow recorder is operative.

(2) Replace tape, disc, or pressure chart as required.

l. Product Recovery System.

(1) Ensure system is secure.

(2) Ensure system has been drained of water and all fuel has been returned to bulk storage.

(3) Ensure system components are in good condition and operational.

m. System Area.

(1) Ensure area is free from safety, fire, and explosive hazards.

(2) Ensure drainage systems are not obstructed.

(3) Ensure lights are operational.

(4) Check fences for condition and ensure a locking system is in use.

n. Strainers.

(1) Pipeline, barge, and tanker strainers will be inspected and cleaned after each receipt or more frequently if local conditions warrant. However, if there is an installed upstream filter within 1 mile of the base, the strainer can be cleaned weekly.

(2) Strainers equipped with a DP gauge will be inspected and cleaned when the DP reaches 10 psi.

o. Pantograph Arm (Type III, IV, and V Systems) – pressurize daily or prior to use. Check for leaks, hose abrasions, and piping discrepancies. Visually inspect nozzle and coupler for leaks and any visible damage. Ensure the nozzle dust cap is in place.

p. Pneumatic Systems – drain condensation and inspect for air leaks.

q. ATG – check nitrogen cylinder on ITT Barton units for serviceability and ensure regulator setting is 20 – 25 psi.

r. Additive Injector – check for leaks, cracked/broken suction calibration gauge sight glass, excessive vibration, and additive supply tank component serviceability. See T.O. 42B-1-1 for injector calibration requirements.

s. Fuel Level Alarms – check for any abnormal conditions that indicate the alarms are not operational.

t. CNG Service Station.

(1) Dispensing Units.

(a) Inspect units for damage and corrosion.

(b) Inspect hoses for damage, blisters, or other signs of wear or scuffing.

(c) Inspect nozzles for wear and proper operation.

(2) Compression Unit.

(a) Check entire system for damage to components, leaks, and oil spots.

(b) Check oil level on all compressors.

(c) Check vapor recovery site gauge for fluid.

(d) Document oil pressure readings while system is running.

(e) Drain gas dryer prefilter.

(f) Check decals and instruction plates for legibility and damage.

3.12 WEEKLY INSPECTIONS.

Items requiring weekly inspection are explained below:

a. Valves.

(1) Plug/Ball Valves – ensure handles are available, valves operate freely, easily, and lubricate as required.

(2) Gate Valves – check for ease of operation and lubricate as required.

b. Electrical Equipment.

(1) Check electrical controls for proper operation, i.e., pump selector switches, light system, etc.

(2) Ensure there is no exposed wiring.

(3) Ensure conduit piping and/or other explosion-proof enclosures are intact.

(4) Ensure emergency switches are mechanically functional and not damaged.

c. Strainers – tank truck/car receipt strainers will be inspected and cleaned weekly or more often if local conditions warrant. If the system has not been used during that period, strainer inspection and cleaning is not required. Strainers equipped with a differential pressure gauge will be inspected and cleaned when the differential pressure reaches 10 psi.

d. Gauges.

(1) Check for proper operation. Gauges malfunctioning or indicating incorrectly must be removed from service immediately and forwarded to the appropriate PMEL activity.

(2) Ensure gauges are not overdue calibration (does not apply to gauges designated as No Precision Calibration Required).

NOTE

Piston type or self-calibrating design DP gauges are not normally calibrated. If these gauges malfunction, contact LFM for repair. For operational check/calibration instructions for the Gammon DP Gauge, contact Gammon Technical Products, (732) 223-4600 and request form No. GGTC2-02/02 or contact DET 3, WR-ALC/AFTH at DSN 785-4311.

(3) Check for damage and/or visual functional discrepancies. Ensure gauge face has not faded and is legible.

e. Dikes.

(1) Check for deterioration.

(2) Ensure exterior dike drain valves are locked in the closed position.

NOTE

Dikes that have a swing arm design that can be locked into an upright position need not have the exterior drain valve locked.

f. Safety Equipment.

(1) Check fire extinguishers for serviceability and proper location.

(2) Ensure exhaust fan and blower (ventilation system) are operative.

(3) Ensure emergency shower and eye bath are operative.

(4) Ensure communication systems are operative.

g. Hydrant System Static Pressure Test – a simple static pressure test, developed locally by the FMT and LFM (with subsequent approval by the MAJCOM Fuels Officer and Fuels Engineer), will be performed on all Type III, IV, and V hydrant systems weekly. Approved test parameters will be incorporated into a Fuels Operating Instruction/Checklist as outlined in AFI 23-201. At minimum, the test parameters will indicate the system static pressure, time period of the test, and the allowable system pressure drop. An example of 1 approved test is:

(1) Pack the hydrant distribution loop and allow the fuel temperature in the loop to stabilize.

(2) Using the automatic mode, bring the system to normal static pressure.

(3) Monitor the system for 1 hour.

(4) Notify LFM if the system pressure drops more than 4 psi.

h. CNG Service Station.

(1) Visually inspect meters for serviceability, if equipped.

(2) Inspect safety/fire protection equipment for serviceability.

(3) Inspect electrical components for serviceability and proper operation.

(4) Document compressor run hours.

3.13 MONTHLY INSPECTIONS.

Items requiring inspection are:

a. Strainers – inspect the following for damage and clean monthly unless local conditions warrant a more frequent inspection:

(1) Hydrant pumphouse inlet line strainers.

(2) Strainers at the inlet side of centrifugal pumps.

(3) Other transfer line strainers.

(4) Strainers equipped with a differential pressure gauge will be inspected and cleaned when the differential pressure reaches 10 psi.

b. Emergency Switches – test for proper operation while the system control panel/operation circuit is energized.

c. Fillstand.

(1) Ensure swing joints operate easily.

(2) Ensure down spout of top loader can extend to the bottom of the refueling unit tank if overhead loading has been authorized.

d. Warning Signs – ensure signs are legible.

e. Identification Markings.

(1) Ensure system is number lettered IAW MIL-STD-161.

(2) Ensure schematics are properly posted.

(3) Ensure all valves are properly numbered and legible.

f. Pipelines – inspect transfer lines IAW federal, state, and local Environmental Protection Agency requirements. The most stringent applies.

g. Sampling Connections – ensure sampling connections are operative and dust plugs are in place.

h. CNG Service Station.

(1) Check drive belts for wear.

(2) Drain liquid from recovery tank.

(3) Check all piping and tubing for external damage.

(4) Inspect markings, warning signs, and emergency switches.

i. Low Point Water Drains. Refer to Chapter 5.

3.14 SEMIANNUAL INSPECTIONS.

a. Strainers – inspect the following every 6 months for damage and cleanliness or more frequently if determined by the FMT.

(1) Type II lateral control pit defuel return line strainers.

(2) Fillstand line strainers.

b. Meters.

(1) Drain meter housing if design permits.

(2) Automated Service Station Pulsars – perform count test every 6 months to ensure serviceability of the pulsar devices. Refer to the Syn-Tech Systems DoD Automated Fuel Service Station Operator's Manual VIR Operating Instructions (Item 41) for test procedures. Pulsars found to be unserviceable need to be replaced. Contact Syn-Tech for guidance.

c. Inspect aircraft-type grounding/bonding receptacles installed at the fillstands to ensure a firm pull is required to withdraw the plug from the receptacle. Approximate pull will measure 8 – 14 pounds on a spring scale, NSN 6635-00-578-5286, or equivalent. A pull of less than 8 pounds indicates a weak or damaged receptacle and will be replaced. A pull of over 14 pounds indicates a possible corroded receptacle which may warrant replacement. See T.O. 00-25-172 for information on a locally fabricated tool assembly to assist in the resistance testing.

d. CNG Service Station.

(1) Inspect all connections for tightness.

(2) Visually inspect storage containers for damage.

CHAPTER 4
FLUSHING HYDRANT SYSTEMS

4.1 GENERAL.

Contamination of hydrant and aircraft systems has occurred where systems were not operated for extended periods of time or where procedures for detection and removal of water were not followed. When contamination has already occurred, the procedures specified herein may not be effective and other action will be required. The guidance provided is concerned primarily with the flushing of idle systems (a system that has been idle or out of service in excess of 30 days). The other conditions described do not occur frequently. The FMT, together with the Operations and Logistics Group, will assure every effort is made to properly schedule the use of hydrant systems to preclude the need for flushing and maximize use IAW AFI 23-201.

4.2 FLUSHING FREQUENCIES.

Hydrant systems will be flushed by line displacement under the following conditions:

a. The system is being prepared for initial service or is being reactivated.

b. The system is being converted to dispense another fuel.

c. Major maintenance or modification has been performed on the system where contaminants could have entered the system.

d. Off-specification product when excessive contamination or free water is suspected.

4.3 FLUSHING PROCEDURES.

The following guidance should be used:

a. Specific operating instructions based on the type of system and the type of control valves installed will be developed by FM and CE personnel.

b. Care will be taken to ensure that all unused laterals are flushed.

c. When flushing idle systems, displace twice the line contents as a minimum through the most distant hydrant outlet. A greater quantity of fuel flushed may be required due to unusual conditions.

d. Flow rates for the flushing operations will be at or near the rated capacity of the system, not to exceed the rated capacity.

4.4 SAMPLING.

After the flushing operation has been completed, sample the system while fuel is flowing IAW T.O. 42B-1-1. If analysis fails, repeat flushing operation until fuel meets specified requirements.

CHAPTER 5
LOW POINT DRAINS

5.1 GENERAL.

The FMT and CE personnel will review drawings of the fuel systems. Drawings will be checked to determine if drain valves are indicated for all low points in the systems. Low point drains not indicated will be included in the drawings. Where low point drains are not provided, action will be initiated to have them installed when warranted. FM and CE will ensure updates to drawings are annotated after any modification or construction which changes operations or fuel flow. Preliminary TAB G-8's will be provided not more than 90 days after the changes are made.

5.2 FUEL SYSTEM DRAINING FREQUENCIES.

All low point drain valves shall be operated at least monthly when the system is not under operating pressure. Ensure all constant pressure hydrant systems are in the **OFF** position. Receipt line low point drains on systems utilized only during the open port season shall be drained prior to the first receipt and after the last receipt of the season as a minimum.

5.3 LOW POINT DRAINING PROCEDURES.

a. Determine line displacement quantity using the system as-built drawings and LFM assistance.

b. Draining will be accomplished using an approved collection container.

c. Once the line displacement quantity and all the water, has been drained, visually examine a sample of the fuel from the piping using a clean glass container to ensure all the water has been removed.

d. If sufficient line pressure prevents adequate low point draining, close the low point drain and pressurize the system. Once adequate pressure is available, continue draining until the piping fuel sample is clear and bright with no visible water.

5.4 SAFETY.

When entering pits, follow procedures for confined space entry contained in AFOSH Standard 91-25.

5.5 ENVIRONMENTAL.

Waste/recoverable fuel and water shall be properly disposed of IAW T.O. 42B-1-23. Ensure compliance with local, state, and federal environmental laws and regulations.

CHAPTER 6
LIQUIFIED PETROLEUM GAS (LPG)

6.1 GENERAL.

This chapter provides generalized standards for storage and dispensing of LPG at base fuels service stations. Federal, state, and local regulations will be followed when LPG is stored and dispensed at Air Force bases.

6.2 FIRE PROTECTION.

Adequate fire protection will be provided as determined by the Base Fire Chief and Safety Office. With a boiling point of −44°F, LPG vapor, which has a lower explosive limit of 2.15% gas in a vapor-air mixture, does present a serious explosive hazard if not handled properly. LPG is odorized by the addition of a warning agent so that it is detectable by smell. In the event of a persistent odor, escaping sound, and/or frosting of parts, isolate the area from ignition sources, evacuate the immediate area, and request assistance from the fire department. LPG is heavier than air and seeks low levels during dispersal. Therefore, potential ignition sources must be kept at least 50 feet from the storage area.

6.3 STORAGE CONTAINERS.

See MIL-HDBK-1022 for guidance.

6.4 MARKINGS ON BULK CONTAINERS.

Each aboveground container will have manufacturer's certification ID plate conspicuously attached. Markings shall be made on a metal plate either by stamping or etching and will be permanently attached in a readily visible location. The following information will be provided:

a. The mark or symbol indicating compliance with the provisions of the ASME Code for Pressure Vessels.

b. The name and address of manufacturer and container serial number.

c. The capacity of the container in water gallons.

d. The container design pressure in pounds per square inch gauge (psig).

e. The wording, THIS CONTAINER SHALL NOT CONTAIN FUEL HAVING A VAPOR PRESSURE IN EXCESS OF 250 PSIG AT A TEMPERATURE OF 100°F.

f. The thickness of the material used in both the shell and the heads.

g. The overall length of the vessel, the outside diameter of the vessel, and the dish radius of the heads used.

h. Marks indicating increments of 20°F and the maximum level the container may be filled with the liquid at temperatures between −20°F and 130°F, except where this information is marked on the liquid level indicator.

6.5 PRESSURE-RELIEF VALVES.

a. Containers shall be equipped with pressure-relief valves having a suitable discharge capacity. Connections for pressure-relief valves shall be installed in a way that allows direct access to the vapor space.

b. LPG does not have a corrosive effect on the container or pressure-relief valve metals. Likewise, the container relief valves are constructed out of corrosive-resistant metals and are protected against the weather. Pressure-relief valves on tanks with a capacity in excess of 2,000 water gallons will be tested once every 5 years. Testing of relief valves on LPG tanks, 2,000 water gallons or less, is not usually required.

c. Safety-relief valves attached to the ASME code containers shall be set by the manufacturer to start discharge at not more than 125% of the design working pressure of the tank.

d. Each pressure-relief valve will be plainly and permanently marked with:

(1) The pressure in psig when the valve is set to discharge.

(2) The actual discharge rating in cubic feet per minute (CFM) at 60°F and 14.7 psig (Example: A safety-relief valve marked 250-4,000 indicates the valve is set to begin discharge at 250 psig and its rate of discharge is 4,000 CFM).

(3) Manufacturer's name and catalog number.

e. Shutoff valves shall not be located between a safety-relief valve and the container.

f. Discharge from safety-relief valves shall be vented vertically to a point at least 10 feet above the container. Vents will be of sufficient size not to restrict the discharge capacity of the valve and shall be fitted with hinged rain caps which will allow free discharge at all times.

g. Externally set or adjusted valves shall be provided with a seal so as to prevent undetected tampering with the pressure setting.

6.6 HOSES, HOSE CONNECTIONS, AND FLEXIBLE CONNECTORS.

a. Hoses, hose connections, and flexible connectors will be made of non-sparking corrosion-resistant steel. Wire braid will be corrosion-resistant material such as stainless steel.

b. Hoses will be designed for a minimum burst pressure of 1,205 psi (250 psi working pressure and will be identified LP-GAS or Liquid Propane Hose (LPH) at not greater than 10 feet intervals.

c. Hose assemblies, after application of connectors, will be capable of withstanding a test pressure of not less than 500 psig.

6.7 HYDROSTATIC-RELIEF VALVES.

Valves designed to relieve hydrostatic pressure, that could develop in sections of liquid piping completely closed off by shutoff valves, will have pressure settings IAW applicable technical data.

a. A positive manual shutoff valve is required at the withdrawal connection.

b. Additionally, an external or internal excess flow control valve is required at the withdrawal connection unless all of the following are compiled with:

(1) Container capacity does not exceed 2,000 water gallons.

(2) The withdrawal outlet is equipped with a manually operated shutoff valve which is threaded directly into the container outlet or an integral part of a substantial fitting which is threaded directly into or on the outlet.

(3) The controlling orifice between the container contents and the shutoff valve outlet does not exceed 5/16 inch in diameter for vapor withdrawal of 1/8 inch for liquid withdrawal.

6.8 EQUIPMENT.

Equipment such as pumps, strainers, meters, and regulators, shall be designed for a rated working pressure of 250 psig.

a. Pumps will be driven by electric motors. Electrical equipment will meet the requirements of the National Electrical Code for Class I, Division I, Group D, hazardous locations.

b. Equipment will be fabricated of materials suitable for LPG.

c. Pumps will be designed for LPG service and may be rotary, centrifugal, or turbine type.

d. Strainers will be designed to minimize particulate materials clogging lines and damaging pumps or meters. The strainers will be accessible for cleaning.

e. An emergency shutoff (master switch) will be provided to shut off electrical power to the pump in the event of a fire or accident.

6.9 LOCATION OF CONTAINER.

See NFPA 58, LP-Gas Code, for instructions.

6.10 FENCING.

LPG bulk storage tanks and dispensing equipment will be within secured chain link fences.

6.11 GROUNDING.

LPG storage tanks shall be grounded IAW the NFPA codes. Electrical continuity will be maintained between dispensing/handling fittings.

6.12 LIQUID TRANSFER.

The FMT, in coordination with the Vehicle Operations Officer, will establish a local liquid transfer checklist for receipt and issue of LPG. These procedures will include the following:

a. A two-person safety policy will be used during LPG transfer operations. One individual will be fully certified in all aspects of the operation and the other will be the receiving vehicle or bulk delivery vehicle operator.

b. Individuals involved in the LPG transfer will wear protective leather gloves and eye protection.

c. The fuels storage operator will assure no open flames or other sources of ignition are within 50 feet of the transfer operation and associated vehicles, tanks, and dispensing equipment.

d. The ignition system on vehicles receiving LPG will be turned off during liquid transfer.

e. Bulk delivery trucks will be electrically bonded to the bulk receiving tank by using standardized grounding/bonding hardware IAW T.O. 00-25-172.

f. Liquid transfers will be accomplished only in outside areas.

g. LPG, either vapor or liquid form, will not be vented to the atmosphere during or following the process of transferring liquid from 1 container to another, except through liquid level gauging devices.

CHAPTER 7
COMPRESSED NATURAL GAS (CNG)

7.1 GENERAL.

This chapter provides generalized standards for receiving, dispensing, and storing CNG at base fuels service stations. Federal, state, and local regulations will be followed when CNG is received, stored, and dispensed at Air Force bases.

7.2 PROPERTIES OF CNG.

Natural gas is a flammable, colorless, tasteless, and non-toxic gas. It is light, weighing about two-thirds as much as air. It has a tendency to rise and diffuse rapidly if relieved from an enclosed system. At atmospheric pressure, the ignition temperature of natural gas-air mixtures have been reported to be as low as 900°F (482°C). The flammable limits of natural gas-air mixtures at atmospheric pressure are about 5 – 15% by volume of natural gas. Due to the flammable characteristics of natural gas and CNG all precautions must be made to eliminate possible sources of ignition.

7.3 FIRE PROTECTION.

Adequate fire protection will be provided as determined by the Base Fire Chief and Safety Officer. Potential ignition sources will be kept at least 50 feet from the storage area. In the event of an escaping air sound and/or frosting of parts, isolate the area from ignition sources, evacuate the immediate area, and request assistance from the fire department.

7.4 FUELING SYSTEMS.

A typical fueling system consists of 1 or more compressors receiving product from a natural gas distribution pipeline or building piping system. A dispensing system consists of a hose, nozzle, and sometimes a meter. The systems may or may not have storage containers. Where storage containers are used, the system is known as a FAST-FILL system with a vehicle filling time of about 3 – 5 minutes. Where storage containers are not used, the system is know as a SLOW-FILL system, and filling times can take several hours.

a. The suction pressure for the compressors range from about 2,500 psig, with most being around 60 psig. The delivery pressure is more than the vehicle pressure system but less than 5,000 psi, with most around 3,500 psi.

CAUTION

Natural gas is compressed to create CNG generating pressures up to 5,000 psi. Caution must be taken during the operation of CNG systems to avoid potential injuries due to these high system pressures.

b. CNG is stored in 2 types of storage systems, bulk and cascade storage. They differ in the manner the CNG is withdrawn from them. Bulk CNG storage can be accomplished with 1 large container or a number of smaller containers manifolded together. As vehicles draw CNG from bulk storage, all containers draw (reduce in pressure) at the same rate. These systems provide less AVAILABLE CNG storage than the cascade system. The cascade system is usually arranged in at least 3 banks of containers with the containers in any 1 bank manifolded together so that each bank acts as 1 large independent container. Valve operation is controlled automatically by a sequencing control panel. The cascade banks are initially filled with CNG in sequence by the compressor to the normal service pressure of the system. The highest pressure bank is refilled first (BANK 1) followed by successively lower pressure banks (BANK 2, BANK 3, etc.). This sequence is called PRIORITY FILL. Storage containers arranged in a cascade can provide more AVAILABLE CNG storage than a bulk storage system for the same size containers.

7.5 DESIGN AND CONSTRUCTION OF CONTAINERS.

See MIL-HDBK-1022 for guidance.

7.6 PRESSURE-RELIEF DEVICES.

Each CNG supply cylinder will be fitted with 1 or more pressure-relief devices. These devices will be IAW Compressed Gas Association (CGA) Pamphlet S-1.1., PRESSURE-RELIEF DEVICE STANDARDS – PART 1, CYLINDERS FOR COMPRESSED GASES. The relief device will be in direct contact with the product stream and will vent to the atmosphere by a method that can withstand the maximum system pressure. The discharge flow rate will not be reduced below that required for the capacity of the container upon which the pressure-relief is installed. They must be located so that the temperature to which they are subjected, will not be higher than the temperature that the

cylinder is subjected. Pressure-relief valves will not be fitted with lifting devices. To prevent tampering by unauthorized personnel, the valve adjustment mechanism, if external, will be designed with a means for sealing. If at any time it is necessary to break the seal, the valve must be removed from service until it has been reset and sealed. The valve will have an identification tag with the valve setting, capacity, and test date.

7.7 PRESSURE GAUGES AND REGULATORS.

a. If a pressure gauge is provided, it will be capable of reading at least 1.2 times the system's design pressure. It will not have an opening that exceeds 0.055 in. (1.4 mm) at the inlet connection.

b. A pressure regulator inlet at each chamber will be designed for its maximum service pressure. Low-pressure chambers will provide for over-pressure relief or will be able to withstand the service pressure of the upstream pressure chamber.

7.8 PIPING.

Pipe, tubing, fittings, and other piping components between a container and the first shutoff valve must be capable of withstanding a hydrostatic test of at least 4 times the rated service pressure without structural failure. Piping components such as strainers, snubbers, and expansion joints will be permanently marked by the manufacturer to indicate service ratings.

7.9 VALVES.

Valves, valve packing, and gaskets will be suitable for CNG over the full range of pressures and temperatures they may be subjected to under normal operations conditions. Shutoff valves will have a rated service pressure not less than the rated service pressure of the entire system and will be capable of withstanding a hydrostatic test of at least 4 times the rated service pressure without rupture. The manufacturer must stamp or otherwise permanently mark the valve body to indicate the service ratings.

7.10 HOSES AND HOSE CONNECTIONS.

a. Hose, metallic hose, flexible metal hose, tubing, and their components will be suitable for the most severe pressure and temperature conditions expected during normal operations. In addition, they will have a burst pressure of at least 4 times the servicing pressure. Hose assemblies will be tested by the manufacturer, or a designated representative, prior to use to at least twice the normal service pressure. Hoses will be distinctly marked by the manufacturer, either by a permanently attached tag or by distinct markings. Markings will indicate manufacturer's name or trademark, applicable service identifier, and design pressure.

b. Vehicle fueling connections must be suitable for the pressure under normal operating conditions and corrosive conditions that may be encountered. The connections will prevent gas from escaping in the event the connector is not properly engaged or becomes separated.

7.11 CNG COMPRESSION, STORAGE, AND DISPENSING SYSTEMS.

a. CNG outdoor facilities will be located aboveground, not beneath electrical power lines, and at a minimum of 10 feet away from the nearest building, public street, or sidewalk line. They must also be at least 50 feet from the nearest rail or railroad main track.

b. A clear space of at least 3 feet must be provided for access to all valves and fittings of multiple group containers.

c. Combustible/ignitable material, weeds, or heavy vegetation will not be permitted within 10 feet of a tank/system.

d. A minimum separation of 20 feet will be maintained between a CNG tank and aboveground storage tanks containing flammable or combustible liquids.

e. CNG indoor facilities will be limited to not more than 10,000 cu. ft. storage of natural gas in each building or room. Deflagration (explosion) venting will be provided in exterior walls or roof only. Vents can consist of any 1 or a combination of the following:

(1) Walls of light material.

(2) Lightly fastened hatch covers.

(3) Lightly fastened, outward opening doors in exterior walls.

(4) Lightly fastened wall or roof.

NOTE

Where applicable, snow loads will be considered.

f. Rooms within or attached to other buildings will be constructed on noncombustible or limited-combustible materials. Access to the room will be from outside the primary structure. These locations must be ventilated utilizing air supply inlets and exhaust outlets to provide air movement. Ventilation will be by a continuous mechanical system or by a mechanical system activated by a continuous monitoring natural gas detection system, preset

to a gas concentration of not more than one-fifth of the lower flammable limit.

WARNING

Although nontoxic, natural gas and CNG can cause anoxia (asphyxiation) in a confined area without adequate ventilation. All natural gas is given a distinct odor for detection purposes. It is mandatory to perform a sniff test prior to going into a confined space at CNG facilities.

g. The gas detection system must be equipped with a sound alarm that activates when the limit of one-fifth of the lower flammable limit is reached. Pressure-relief devices must channel escaping gases outside and then upwards to a safe area. Access doors must have warning signs with the words, WARNING – NO SMOKING – FLAMMABLE GAS. Wording will be bright red letters on a white background not less than 1 inch high.

h. Suitable means will be provided to protect the CNG storage tank and appurtenances from damage by vehicles. Steel posts, concrete pillars, bollards, or 55-gallon drums filled with sand can be used for this purpose.

7.12 GROUNDING.

CNG storage tanks shall be grounded IAW NFPA codes.

7.13 EMERGENCY SHUTDOWN EQUIPMENT.

a. The fill line on a storage container must be equipped with a back-flow check valve to prevent discharge of natural gas in case a line, hose, or fitting ruptures.

b. A manually operated shutoff valve must be installed in the manifold as close to a container or group of containers as practical. This valve must be downstream of the back-flow check valve.

c. Gas piping from an outdoor compressor or storage system into a building must be provided with shutoff valves located outside the building.

d. An emergency shutdown device must be provided at the dispensing area and also at a location remote from the dispensing area. This device, when activated, will shut off the power and gas supply to the compressor and the dispenser. Emergency devices will be distinctly marked for easy recognition with a permanently affixed legible sign.

e. A breakaway device will be installed at every dispensing point. The device will be arranged to separate by a force not greater than 150 lbs when applied in a horizontal direction.

f. Control circuits will be arranged such that when an emergency shutdown device is activated or electric power is cut off, the systems that are shut down will remain inoperative until they are manually activated or reset after a safe situation is restored.

g. Each line between a gas storage facility and the dispenser at a fast-fill station will have a valve that will close when:

(1) The power supply to the dispenser is cut off.

(2) An emergency shutdown device at the refueling station is activated.

h. A fast closing, QUARTER TURN manual shutoff valve must be provided at a fast-fill station upstream of the breakaway device. It must be accessible to personnel operating the dispensing unit. A self-closing valve may be used provided it is located immediately upstream of the dispenser or the dispenser is equipped with a self-closing valve which closes each time the control arm is turned to the OFF position or an emergency device is activated.

i. A self-closing valve will be provided on the inlet of the compressor that will shut off the gas supply to the compressor when an emergency shutdown device is activated, a power failure occurs, or when power to the compressor is switched off.

7.14 DISPENSING SYSTEM OPERATION.

a. DOT and CT cylinders will not be subjected to pressures in excess of 125% of the marked service pressure. A CNG supply container will not have a settled pressure above the service pressure stamped on the container and displayed on a label near the filling connection corrected for the ambient pressure at time of filling. CNG dispensing systems will be equipped to automatically stop CNG flow when a CNG supply container reaches the temperature correct fill pressure.

b. Prior to CNG being issued to a vehicle, the motor will be stopped, the hand or emergency brake will be applied, and (depending on the vehicle type) chocks will be used to prevent the vehicle from rolling. Sources of ignition will not be permitted within 50 feet of any CNG servicing operation. The system must have the capability to be depressurized to assist with disconnection.

c. Warning signs will be posted within 50 feet of CNG dispensing stations with 2-inch red letters on white background and the words NO SMOKING – FLAMMABLE GAS. Additional warning signs must be posted at the dispensing station and compressor areas with the words STOP MOTOR, NO SMOKING, FLAMMABLE GAS. The lettering on the signs must be large enough to be visible and legible from each issue point.

CHAPTER 8
GLOSSARY OF SYSTEM COMPONENTS

8.1 GENERAL.

This chapter provides general information on typical components used in the receipt, storage, and issue of bulk petroleum products. The components identified may be used in various configurations and are listed alphabetically.

8.2 AIR ELIMINATOR.

A device designed to release trapped air from the fuel system. Air eliminators are provided at various locations throughout the fuel system for removal of air.

8.3 AUTOMOTIVE SERVICE STATIONS.

The system is designed to receive, store, and issue ground fuels to vehicles. Storage and dispensing facilities for handling automotive engine fuel are similar to commercial service stations. A pump with meter is provided in a single unit. When more than 1 grade of motor vehicle fuel is required, separate storage tanks and dispensing units will be provided for each grade of fuel dispensed.

8.4 BONDING.

To further ensure that all parts of a system are at the same potential all system components are interconnected, therefore reducing the hazard potential associated with static electricity.

8.5 BULK STORAGE.

The facilities provided for receiving and storing a reserve supply of petroleum product until it becomes necessary to replenish operating tanks or other conveyances. This system is not normally used to deliver fuel directly to an aircraft.

8.6 CLEANOUT CONNECTION.

A pipe extending to the bottom of the tank to completely empty it prior to cleaning operations.

8.7 DOME COVERS.

Lids on the openings of tank cars, tank trucks, etc. through which fuel transporters can be filled and gauged.

8.8 DIKE.

A required earthen, asphalt, or concrete barrier used to contain product in the event of an aboveground tank rupture. Dikes are equipped with a lock-type drain valve(s) or swing arm(s).

8.9 EMERGENCY SWITCH.

These switches are provided at strategic locations so operating personnel can stop all fueling operations in the event of fire or other mishap.

8.10 FILL CONNECTION.

It consists of a pipe extending to near the bottom of each tank, fitted with a splash deflector designed to minimize the incoming fuel from stirring up sediment and water and to minimize static charge buildup produced by turbulence.

8.11 FILLSTANDS.

A dispensing line from either the bulk storage issue/transfer pipeline or the issue line from 1 or more operating storage tanks. It is used to provide the fuel for filling tank trucks. The line terminates in 1 or more fill sites, and each fillstand site is equipped with a switch to start and stop the pump supplying the fuel. The only approved types of fillstands are:

a. Bottom Loader – permits filling of tank trucks/cars by using a pipe/hose assembly extending from the fillstand to a refueling receptacle assembly installed on the lower portion of the tank truck/car. It is the required method for filling all USAF refueling units.

b. Top Loader – a device consisting of an overhead filling assembly and downspout.

8.12 FILTER SEPARATOR.

A cylindrical vessel containing elements or cartridges designed to remove fine sediment particles and to coalesce and separate water from fuel.

8.13 FLEXIBLE SEALS.

The floating tank roof is equipped with flexible fabric seals for protection against evaporation losses and fire hazards. The seal will compensate for reasonable variations in the tank diameter or shell out-a-round.

8.14 GAUGE HATCH.

An opening in the fuel tank used to measure the elevation of fuel and water with gauging equipment.

8.15 GROUNDING.

The earth, due to its physical size, is considered to be a source of constant electrical potential. Grounding means providing an electrical path to ground (or earth). By grounding the different components of a refueling system (tanks, pipes, valves, etc.), these components are all brought to the same electrical potential.

8.16 GUIDE DEVICES.

The floating roof is prevented from rotating by means of a vertical guide cable or column attached to the tank shell and a special trough in the sealing ring which follows the guide as the roof moves up and down.

8.17 HIGH LEVEL SHUTOFF.

A valve or device on a tank to automatically shut off fuel flow when the tank reaches a preset level.

8.18 HYDRANT REFUELING SYSTEM.

In hydrant systems, fuel is pumped from operating storage tanks through a piping system to outlets installed in the ramp or parking areas. Connections to an outlet with a hose (modified Type I), hosecart (Types I and II), hydrant servicing truck (Type III), or pantograph dispenser (Type IV and Type V) and to an aircraft with a single-point nozzle providing a system for servicing aircraft. Hydrant systems installed at AF locations have 4 basic designs.

a. Type I — Panero System – this system was first installed in 1950. Identifying features of this system are: a single outlet, gravity defueling, and a control pit originally designed with a filter, meter, and control valves. All filter separators and meters in the control pit have been removed. At some locations, the system has been modified with a low profile filter in the control pit.

b. Type II — Pritchard System – this system was installed after 1955. It permits servicing of the aircraft at its normal parking location. A number of outlets are serviced from a single pumphouse. With this system, the filter separator and meter are located on the mobile hosecart used for connection between the outlet and the aircraft. A defueling pump is installed in each lateral control pit for the defueling operation.

c. Type III — Phillips Constant Pressure System – this system consists of multiple hydrant outlets in which fuel is constantly under pressure ready for dispensing to aircraft on demand. The system includes 600-gpm or 1200-gpm pumps, filter separators, contamination monitors, and a pressure and flow recorder mounted on an open pad near the hardstands. Fuel is supplied to all outlets through a loop of underground corrosion-resistant piping. A hydrant servicing vehicle provides metering capability for fueling and defueling operations.

d. Type IV — Pressurized Hot Fueling System – the hot fueling system incorporates the ON DEMAND dispensing characteristics of the Type III System, with similar controls and special safety provisions. In this system, fuel is received in tanks from bulk storage and then pumped through a loop of underground corrosion-resistant piping using 600-gpm pumps, filter separators, and contamination monitors to pantograph fueling arms equipped with a nozzle.

e. Type V – similar to the Type IV System but is used for in-shelter fueling operations.

8.19 HYDRANT LATERAL CONTROL PIT.

In Type II Systems fuel enters the HYDRANT LATERAL CONTROL PIT after being pumped from the operating storage area into the pipeline which serves the refueling area. Automatic or solenoid controlled valves in this pit provide surge protection and control of the fueling/defueling operations. A defueling pump, a strainer in the defuel line, and plug/ball valves are provided. For rapid defuel the system must be modified by installing a line that bypasses the defuel pump.

8.20 HYDRANT OUTLET ASSEMBLY.

A recessed opening covered with a lid flush with the ramp. A 4-inch hydrant coupler adapter, installed within the opening, is flanged to the supply pipeline. The adapter is equipped with a spring-loaded closed poppet, designed to open when the hydrant quick coupler is attached. Dust cover is also provided to seal the adapter closed when the coupler is removed.

8.21 HYDRANT COUPLER.

The hydrant coupler is made of nonferrous metal, and is equipped with a spring-loaded poppet or disc. The seal between the hydrant quick coupler and the adapter is maintained by an O-ring against the adapter. The coupler and adapter are held together by positive locking when the coupler is placed on the adapter and properly positioned.

8.22 IMMEDIATE OPERATING STORAGE.

Facilities constructed for storing and dispensing fuel directly to the aircraft.

8.23 LIQUID LEVEL GAUGE.

A direct reading dial mounted on a pipe that extends to a connection on an underground tank. The dial is calibrated to indicate the approximate volume of fuel in the tank.

8.24 LOW LEVEL SHUTOFF.

This mechanism shuts down the pump when fuel reaches a predetermined level to prevent draw off of tank bottoms and running pump dry.

8.25 LOW POINT DRAIN.

A low point of a fuel system or storage tank where water will collect for draining purposes.

8.26 MANHOLE.

An opening in a tank to allow a person to enter the tank for inspection or cleaning. The manhole cover and gasket must be in place and tightly bolted during routine operation.

8.27 METER.

A device for measuring the quantity of fuel.

8.28 OIL/WATER SEPARATOR.

A device to separate fuel and water mixture from drainage within the dike area around aboveground storage tanks; the separator diverts water to the storm drain and fuel to the filter/separator relief tank.

8.29 PRESSURE AND FLOW RECORDER.

This mechanism is used in the Type III, Type IV, and Type V Hydrant Systems. It maintains a continuous record of the systems operating pressure and flow.

8.30 PRODUCT RECOVERY SYSTEM.

This system removes fuel and water from the tank water drains. It permits the fuel and water to separate, the water to be drained off, and the fuel to be returned to the bulk storage tank.

8.31 PUMPHOUSE.

Fixed facilities housing pumps and controls used for moving fuel. The construction of these facilities varies according to location and climatic conditions, from an open pad to an enclosed heated building.

8.32 PUMP SELECTOR PANEL.

Permits personnel to select the individual fuel pumps to be operated. The panel has a main power control switch and pump selector switches. The selector switches are used to select the pump or pumps which are to be controlled. One selector switch is provided for each pump.

8.33 PUMPS.

Pumps are used for loading, unloading, and transferring product. Centrifugal and deep well turbine pumps are the most commonly used in fuel systems. Deep well turbine pumps are normally used in below ground tanks, while centrifugal pumps are used in aboveground tanks.

8.34 RAILROAD SPUR.

A separate railroad track adjacent to the fuel storage area for unloading tank car shipments of fuel. This spur must be insulated from the adjoining railroad track by means of insulation blocks, and each of the rails on both sides of the track must be bonded electrically. The insulated tracks must be bonded and grounded with the piping at each unloading coupler to insure proper control and discharge of static electricity.

8.35 REMOTE ELECTRICAL CONTROL CABLES.

These flexible cables are constructed with a pushbutton switch completely enclosed in a sealed rubber housing used for remote control of pumps from Type II hydrant outlets. These cables in Type II and some in Type I Hydrant Systems are being replaced with a magnetic pump control switch assembly. This switch uses a magnet that activates low voltage relays to the pump switches. The operator can disengage the switch by simply removing the magnet from the relay cover.

8.36 RIM VENT.

It is installed at the outer edge of the roof on floating roof tanks to allow air to enter and exit the tank during product movement.

8.37 ROOF DRAIN (OPEN TOP FLOATING ROOF TANKS).

The drain line may consist of various lengths of pipe connected to specially built joints. A drain valve is provided on the outside of hose only near the tank bottom. This drain removes water from the floating roof without allowing the water to come in contact with the fuel.

8.38 SIGHT GAGE/GLASS.

On storage tanks, it is used to indicate the amount of liquid in the tank. Sight glasses on filter separators show how much water is in the separator sump. Product recovery system sight glasses indicate the amount of water drawn from above the ground bulk storage tanks.

8.39 STRAINERS.

Strainers are screens installed at selective points in fuel receiving and dispensing systems for removal of solid contaminants. Strainers are of different types such as basket, nozzle, and Y-type.

8.40 SUMP.

The sump is the low point of tanks, pits, and filter separators where water accumulates.

8.41 SURGE SUPPRESSER.

Surge suppressers are installed in fuel systems and refueling equipment to reduce hydraulic shock when valves are suddenly opened or closed during pumping operation.

8.42 SWITCH LOADING.

The loading of a product into a receiving vessel that contains product or product residue of a different flash point.

8.43 TANKS.

Tanks are used to store petroleum, oil, and lubricant products according to mission requirements. The most common types currently in use are: Floating Roof Tanks (open or covered top), Fixed Roof Tanks, Fixed Roof with Floating Pan and Horizontal Cylindrical. Underground tanks can also be classified as cut and covered or hardened.

8.44 VALVES.

Numerous types of valves are installed in fuel systems. The basic function is to control the rate and/or direction of product flow.

8.45 VAPOR RECOVERY SYSTEM.

An enclosed system of piping, vessels, and hoses arranged to collect volatile hydrocarbon vapors, condensing them into a liquid or completely incinerating them so that no emissions pollute the air.

8.46 VISI-FLO.

A transparent flange inserted at the offloading header to monitor fuel flow while offloading a tank car/tank truck. The purpose of this flange is to provide the storage operator a means to determine flow or no fuel flow conditions. This visi-flow eliminates the need for a man on top of the tank car/tank truck. The maximum working pressure is approx. 275 psi at 100°F. The viton seal has a 350° maximum working temperature.